Lander Technology: LOX/CH4 Engine

Completed Technology Project (2017 - 2020)

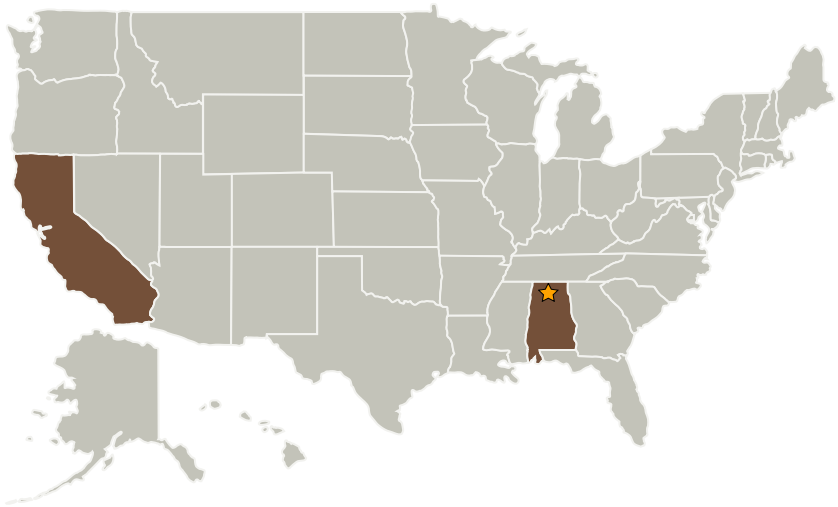
Project Introduction

Hotfire testing is being performed of a MSFC-developed 4500-lbf thrust regeneratively cooled LOX/CH_4 engine with additively-manufactured thrust chamber. Testing of the 4500-lbf thruster will demonstrate methane-based regenerative cooling, verify performance, and anchor thermal models. The design can be scaled and fabricated for higher thrust levels (e.g. 100 kN / 22 klbf class engine). A parallel effort is underway witha 1000 lbf LOX/CH4 thruster with both additively-manufactured thrust chamber and injector.

Anticipated Benefits

This technology has potential application to human and robotic missins to the Moon and Mars. The benefits include enabling the development of space propulsion systems that use non-toxic ("green") propellants, potentially producible from space resources. Liquid oxygen/methane (LOX/CH_4) engines feature high performance including high specific impulse (Isp), and are being produced using new, lower-cost additive manufacturing techniques (3-D printing). These qualities improve the operability, affordability, and sustainability of space systems.

Primary U.S. Work Locations and Key Partners



META4 – Methane Engine Thrust Assembly for 4K lbf: assembled onthestandand hot-fire testing

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama

Co-Funding Partners	Type	Location
Masten Space Systems, Inc	Industry	Mojave, California

Primary U.S. Work Locations	
Alabama	California

Images

MET1 – Methane Engine Thruster for 1K lbf
MET1 – Methane Engine Thruster for 1K lbf: assembled on thestandandhot-fire testing *(https://techport.nasa.gov/image/32130)*

META4 – Methane Engine Thrust Assembly for 4K lbf
META4 – Methane Engine Thrust Assembly for 4K lbf: assembled onthestandand hot-fire testing *(https://techport.nasa.gov/image/32129)*

Organizational Responsibility

Responsible Mission Directorate:
Exploration Systems Development Mission Directorate (ESDMD)

Lead Center / Facility:
Marshall Space Flight Center (MSFC)

Responsible Program:
Exploration Capabilities

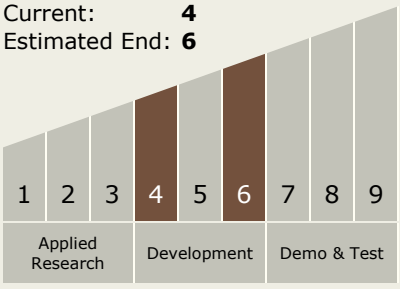
Project Management

Program Director:
Christopher L Moore

Project Manager:
Greg Chavers

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **6**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic

Target Destinations

The Moon, Mars, Others Inside the Solar System

Supported Mission Type

Projected Mission (Pull)